# Ontology

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# **What is:** Ontology

Etymology:

- ontos (**being**)
- logos (study, discourse)

Meaning: “*The study of* **being**”

# **Why:** Ontology

- Provides a unified way to organize knowledge.
- Ensures consistency in measurement.
- Enables machine reasoning and intelligent inference.
- Supports search, categorization, automation.

# **How:** Ontology Works

1. Identify Entities: What things exist? (objects, processes, states, abstract objects)
2. Determine Categories: What kinds of things exist? (substances, qualities, quantities, relations, events)
3. Define Properties and Behaviours: What attributes do they have(color, mass, charge, shape, function)
4. Map Relations: How are things connected? (part-of, made-of, depends-on, located-in, causes)
5. Build Structure: Hierarchies, Graphs, Networks, Concept maps, Category diagrams

# **Identify:** Entities

Meaning: What things **exist** in the domain?

Examples:

- In physics → space, time, field, force
- In biology → cell, gene, organism
- In chemistry → atom, molecule, reaction
- In computing → file, user, process, server
- In everyday world → car, tree, person, city

# **Determine:** Categories

## Meaning: What kinds of things are they?

Examples:

- Electron -> particle (substance)
- Mass -> quantity
- Color -> quality
- Bonding -> relation
- Melting -> event
- Temperature state -> state

Categories classify entities.

# **Define:** Properties and Behaviours

## Meaning: What attributes do they have, and how *do* they *act*?

Properties (attributes):

- Electron → charge −1e, spin 1/2
- Water → boiling point 100°C
- Atom → atomic number
- Car → color, weight
- Person → height, age

Behaviours (*actions / responses / patterns*):

- Electron → moves in field, emits photon when transitioning
- Water → evaporates when heated
- Chemical → reacts with oxygen
- Magnet → attracts metal
- Software process → executes tasks, spawns threads

Properties = what something has.

Behaviours = what something *does*.

# **Map:** Relations

Meaning: How are entities *connected*?

Examples:

- part-of: wheel → car
- made-of: molecule → atoms
- located-in: city → country
- depends-on: plant → sunlight
- causes: heat → expansion
- interacts-with: proton ↔ electron
- subset-of: mammals → animals

"Relations *map* how entities *interact* and *depend* on **one another**."

# Terminology:

- Being, Existence
- Entity, Cause
- Individual, Universal
- Essence, Accident
- Identity, Persistence
- Potentiality,  Actuality
- Abstract , Concrete
- Discrete, Continuous
- Substance, Form, Matter
- Occurrence
- Phenomenon
- State, Event, Process
- Disposition, Capability
- Modality
- Quantity, Quality
- Space, Time, Force
- Function, Permutation
- Condition, Constraint